REMARKS

This paper is intended as a full and complete response to the Office Action dated October 10, 2006, having a shortened statutory period for response set to expire on January 10, 2007.

Claims 1-26 are pending in the Application.

Applicant has no new amendments to Claims. Applicant advises Examiner to evaluate the following arguments in light of the amendments made in the office action dated 07/18/2006.

Applicant wishes to thank Examiner Daniel Miller for his assistance during the USPTO in person interview on January 30, 2007. The affidavit as requested by the Examiner to overcome the art of record is included in this office action. The pertinent parts as discussed in the USPTO interview is paragraph 9 of the affidavit.

I. Claim Rejections 35 USC § 103

The Office Action rejected claims 1-25 under 35 U.S.C. 103(a) as being unpatentable over *Cerutti et al.* (U.S. 5,512,235) in view of *Brunson* (U.S. 2002/0179204 A1).

Applicant's Application is for a thermally treated carbide without fractures, made by a specific process that prevents over-stressing, inter-material stresses, and produces a product that lacks fractures on a microcrystalline level.

Applicant's process comprises cooling a carbide at a first temperature rate, maintaining a first target temperature, heating the carbide at a second temperature rate, holding the carbide at a second target temperature for at least fifteen minutes, then repeating, at least two additional times, the steps of cooling the carbide, maintaining the temperature, heating the carbide, and holding the carbide. (Applicant's Application, Claim 1 as amended)

Cerutti et al. refers to a method of using high pressure and high temperature for creating a metal carbide supported polycrystalline compact in a high temperature and high pressure apparatus (*Cerutti et al*, Claim 1). *Cerutti et al.* involves a method including the steps:

placing a material in a chamber;

providing pressure to the material in the chamber; and

subjecting the pressured material to high temperature and high pressure conditions. (*Cerutti et al.* Claim 1)

Cerutti et al. does not teach a thermally treated carbide without fractures, produced using a process that includes repeated cryogenic cycles, repeated thermal tempering cycles, repeated holding of the material, and controlled temperature rates of change.

Applicant's process uses specific temperature rates of change ranging from 0.25 degrees Fahrenheit per minute to 20 degrees Fahrenheit per minute that are highly controlled, preventing over-stressing of the material, which can cause fractures. (Applicant's Application, Claim 1,) Uncontrolled processes lacking a controlled rate of change relating to the temperature of a material can result in over-stressing and even fracturing, rendering the material useless. (Applicant's Application, Paragraph 4, 8-9, 19)

A controlled temperature rate of change as taught by Applicant also allows a material to cool or heat evenly, preventing inter-material stresses. (Earl A. Carlson, *Cold Treating and Cryogenic Treatment of Steel*, ASM Handbook, Vol. 4, p.204, March 2001)

Applicant's process further involves cooling the material to a specific and controlled first target temperature ranging from -120 degrees F and -380 degrees F (Applicant's Application, Claim 1). This first target temperature is uniquely useful for preventing and relieving stresses in a ferrous material, and facilitates the conversion of austenite into martensite. (Earl A. Carlson, *Cold Treating and Cryogenic Treatment of Steel*, ASM Handbook, Vol. 4, p.204, March 2001)

Applicant's process also involves increasing the material to a highly controlled and specific second target temperature ranging from 0 degrees F and 1400 degrees F at a second temperature rate ranging from 0.25 degrees F and 20 degrees F per minute, holding the material at that second target temperature for at least fifteen minutes, and repeating these steps at least two more times. (Applicant's Application, Claim 1) The second target temperature and second temperature rate can be selected to provide the treated carbide without fractures with select characteristics and qualities. (Applicant's Application, Paragraph 27)

The temperature rates taught by Applicant, coupled with the repeated cryogenic treatment and repeated high temperature holding of the material form a thermally treated carbide without fractures, which is relieved of stresses at a microcrystalline level. *Cerutti et al.* makes no mention of the use of repeated cooling, holding, or heating to improve the performance of a material or to prevent over-stressing.

Applicant teaches a process that includes the steps of: cooling a carbide at a first temperature rate to a first target temperature, maintaining the cool temperature for at least two hours, heating the carbide at a second temperature rate to a second target temperature, holding the carbide at that second target temperature for at least fifteen minutes, then repeating the entire process at least two times consecutively. (Applicant's Application, Claim 1)

Brunson teaches a deep cryogenic tempering process for brake components such as rotors and drums, wherein the unique processing profile is dependent on the properties of the specific brake components. (*Brunson*, Abstract) *Brunson* involves a method including the steps:

cooling a brake component at a descent rate until the brake component temperature is approximately -300 degrees F.;

maintaining the brake component temperature at -300 degrees F. for a stay time;

raising the temperature of the brake component to approximately 300 degrees F. at an ascent rate;

maintaining the temperature of the brake component at 300 degrees F. for a post temper

time; and

lowering the temperature of the brake component to room temperature at a cool down rate. (*Brunson*, Claim 1)

Brunson also teaches a method that includes repeating the steps of raising the brake component temperature to approximately 300 degrees F, maintaining the temperature of the brake component for a post temper time, and lowering the temperature of the brake component to room temperature at a cool down rate at least once. (*Brunson*, Claim 2) *Brunson* further teaches repeating the above steps twice for a second post temper time and a third post temper time. (*Brunson*, Claim 3)

Applicant's process includes treating a material with multiple cryogenic cycles, while the method of *Brunson* teaches only a single cryogenic cycle. Unlike the method taught by *Brunson*, Applicant's process repeats the steps of cooling a carbide at a temperature rate to a target temperature ranging from -120 degrees F to -380 degrees F, and maintaining the target temperature for at least two hours during each repetition of the process, in addition to repeating the latter steps of the process (Applicant's Application, Claim 1, as amended).

In the art, and as practiced by *Brunson*, it has typically been the practice to subject a material to cryogenic treatment only once, even when subjecting the material to multiple tempering cycles at high heat, due to the widely held belief that additional cryogenic cycles provide very little or no benefit to the material. (Earl A. Carlson, *Cold Treating and Cryogenic Treatment of Steel*, ASM Handbook, Vol. 4, p.204, March 2001)

The benefits of cryogenic treatment on steel and other materials have previously been in doubt, and many metallurgical professionals have expressed reservations about its value. (Earl A. Carlson, *Cold Treating and Cryogenic Treatment of Steel*, ASM Handbook, Vol. 4, p.204, March 2001)

While cryogenic treatment of metal has been used in the art prior to one or more heated tempering cycles, no existing patented method or process has made use of successive cryogenic events, instead relying solely on a single cryogenic treatment. Applicant has

submitted an Information Disclosure Statement listing such patents. (Attachment B—Information Disclosure Statement, as researched by Inventor)

Applicant's repeated cryogenic treatment of a material is unique to the art, and produces a treated carbide that is uniquely free of fractures due to the enhanced prevention of over-stressing provided by multiple cryogenic cycles. The repeated cooling of the carbide at a first temperature rate to a first target temperature avoids over-stressing of the carbide, and prevents fracturing. (Applicant's Application Paragraphs 8-9, 19) The addition of a second cryogenic material to reduce the temperature of the metal carbide to a third target temperature at a third temperature rate results in a treated carbide without fractures, and removes stresses caused by the previous heating of the carbide. (Applicant's Application Paragraph 9) Applicant's further repetitions of cryogenic treatment of the carbide between heated tempering cycles further prevent both stresses inherent in the material and stresses related to the previous heating cycle.

The treated carbide without fractures taught by Applicant is useful in the manufacture of tools and tool components, machinery, engine parts, wear surfaces and like articles from various steels and materials that are used for high wear applications, including drilling, mining, and subsea equipment and cutting tools. (Applicant's Application, Paragraphs 3-7) The treated carbide without fractures taught by Applicant is uniquely free from stresses and fractures. (Applicant's Application Paragraphs 3-7)

Applicant also teaches specific and highly controlled temperature rates of change ranging from 0.25 degrees Fahrenheit per minute to 20 degrees Fahrenheit per minute, not taught by *Brunson* (Applicant's Application, Claim 1 as amended) The specific temperature rates taught by Applicant are used to prevent over-stressing and fracturing in the material. (Applicant's Application, Paragraphs 8-9, 19)

A highly controlled temperature rate of change allows a material to heat or cool evenly, preventing inter-material stresses. (Earl A. Carlson, *Cold Treating and Cryogenic Treatment of Steel*, ASM Handbook, Vol. 4, p.204, March 2001) Controlled temperature rates can also be used to provide selected metallurgical properties to the treated carbide without

fractures. (Applicant's Application, Paragraph 27)

Applicant further teaches a process that includes a separate holding step not taught by *Brunson*, wherein the chamber temperature is increased to a second target temperature, and the carbide is permitted to age for at least fifteen minutes. (Applicant's Application, Claim 1 as amended) The holding of the carbide, not taught by *Brunson*, is effective in preventing over-stressing and fractures and has cumulative effects when coupled with the cooling and heating steps of Applicant's process. (Applicant's Application, Paragraph 29)

Applicant teaches a thermally treated carbide without fractures, made by a specific process including repeated cryogenic cycles, repeated tempering cycles, and repeated holding cycles, using controlled temperature rates of change. (Applicant's Application, Claim 1 as amended)

Cerutti et al. teaches a method of using high pressure and high temperature for creating a metal carbide supported polycrystalline compact in a high temperature and high pressure apparatus (*Cerutti et al*, Claim 1), while *Brunson* teaches a method of tempering brake components involving a single cryogenic tempering cycle and between one and three heated tempering cycles. (*Brunson*, Claims 1-3)

The method taught by *Brunson* is not suitable for the creation of polycrystalline compacts taught by *Cerutti et al. Cerutti et al.* teaches the use of high temperature, high pressure conditions to facilitate the creation of polycrystalline and cubic boron nitride compacts supported on a metal carbide substrate. (*Cerutti et al.*, Columns 3-4, Line 61-Line 3) The apparatus taught by *Cerutti et al.* is subjected to high temperature, high pressure conditions to sinter crystalline particles into a polycrystalline compact layer and to bond the polycrystalline compact layer to a metal carbide layer. (*Cerutti et al.*, Column 4, Lines 18-24)

Cerutti et al. thereby teaches away from the deep cryogenic treatment method taught by *Brunson*. Applicant would argue that it would not have been obvious to subject a polycrystalline or cubic boron nitride compact supported on a metal carbide substrate to the deep cryogenic treatment method for brake components taught by *Brunson*.

Claims 2-8 and 10-25 depend upon independent Claim 1, and therefore include all of the limitations thereof. Since Applicant believes that independent Claim 1 is patentably distinct from *Cerutti et al.* in view of *Brunson*, Claims 2-25 are patentably distinct from *Cerutti et al.* in view of *Brunson* as well.

Reconsideration of the rejection to the Claims in view of the remarks is respectfully requested. Applicant believes that no new subject matter has been added.

CLOSING REMARKS

Applicant appreciates the Examiner's time and attention to this matter. Applicant believes the Claims as now provided are in condition for allowance. Reconsideration of this application is respectfully requested. The Applicant invites the Examiner to contact the Applicant's attorneys at (713) 275-3400 should any questions arise concerning this Application.

Respectfully submitted,

Date: 2/8/07

Wendy Buskop

Wendy Buskop, Reg. No. 32,202

Please mail correspondence to:

The address associated with **customer number 29637**.

Wendy K.B. Buskop
Buskop Law Group, P.C.
1776 Yorktown, Suite 550
Houston, Texas 77056
713.275.3400